# THE CARBRO PROCESS

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# The Carbro Process

All who desire their photographic work to be above the ordinary must, at some time or other, have considered working the Carbon process. Many who know nothing of its details are strongly attracted by the results they have seen, and by the striking variety of colours and base papers which are always at the command of the artistic worker. There are, however, certain disadvantages, especially the necessity for daylight printing.

Carbro, the modern descendant of Carbon, overcomes all these difficulties and offers the ambitious photographer an easy method of making prints which are identical in all respects with Carbon prints. Instead of being made by the action of light through a negative, they are the result of carefully regulated chemical action on a bromide print—hence the name "Carbro"—Carbon from Bromide.

Anyone who has facilities for making contact or enlarged bromide prints, and can command a supply of water has all the main essentials for making Carbro prints of any size.

## THE PROCESS IN BRIEF

A piece of "Pigment Paper" is "sensitised" by immersion in a solution containing Bichromate, Ferricyanide and Bromide of Potassium for three minutes. It is then passed into a solution of Formaline and acid for a varying number of seconds, according to the brilliance of the print

desired, and on withdrawal from this acid bath is squeegeed on to a thoroughly wetted bromide print, with which it is left in contact for 15 minutes. The pigment paper is then stripped off the bromide and squeegeed on to an appropriate "Transfer Paper," which again must have been well soaked. After 20 minutes or so it is ready for development in warm water as in ordinary Carbon printing. The finished print is then treated with an alum bath and dried.

## MATERIALS REQUIRED

In addition to a good Bromide print and the essential chemicals, which will be dealt with later, a supply of Pigment Paper and Single Transfer paper is necessary, both these being the same as are used in the Carbon process. The Pigment Paper consists of paper coated with soluble gelatine with which is mixed appropriate pigments; an extensive range of colours is manufactured to suit all types of subject. The Transfer Papers are also made in a variety of shades and surfaces which determine the character of the resulting picture; they are coated with a very thin film of insoluble gelatine to make the final image adhere.

A squeegee is also an essential item in this process, the flat variety being found much better than the roller type; five inches is a convenient length for all sizes of print up to whole-plate.

The two dishes used for the chemicals should be made of porcelain, and should be at least an inch larger than the pigment paper to be immersed in them; if enamel dishes are preferred care must be taken not to crack them, as the solutions penetrate through even minute cracks and eat away the iron. Papier mâché is unsuitable.

Two larger dishes are also required for soaking and washing purposes. Also a sheet of thick glass is a necessity for squeegeeing. If possible this should be supported

horizontally on blocks of wood inside a sink, so that any splash made will not matter. Finally some greased or waxed paper, a few blotting boards or fluffless blotting paper, and perhaps a small palette knife, or even a penknife, complete the outfit.

What happens in this process is that the chemicals taken up by the pigment paper bleach the silver image of the bromide print, and at the same time, tan or insolubilise a portion of the gelatine of the pigment paper exactly corresponding to this image. This insoluble gelatine image adheres to the transfer paper, but during the process of development all the soluble gelatine is removed in the warm water, leaving an image in relief made up of varying thicknesses of insoluble pigmented gelatine.

It is this relief image which gives depth to the shadows and the unique quality which is characteristic of Carbro prints.

Those who are interested in the technical side of the process and require fuller details, are referred to a comprehensive paper in the *Photographic Journal* for March, 1926.

The following paragraphs give the process in greater detail, and according to the methods which have been found most successful by the Autotype Company. It does not follow that the conditions specified are the only ones that can be used successfully, but beginners are advised to follow them carefully.

## QUALITY OF THE BROMIDE PRINT REQUIRED

Any of the standard makes of Bromide paper is suitable for Carbro work, but Platino matt papers are preferable as being easier to work from; glossy papers are liable to give difficulty when squeegeeing the pigment paper on

to them, while the rough grades tend to retain air in the crevices and so prevent contact with the sensitised pigment paper.

Nowadays, bromide papers are prepared with a supercoating of gelatine in order that they may better resist "stress" markings. This supercoat occasionally causes granularity and a loss of high-lights in Carbro prints. These troubles can be overcome by making the bromide prints somewhat darker, or preferably by using a special unsupercoated bromide paper which the Autotype Company is able to supply.

As the gradation and richness of a print made by the aid of light is dependent on the quality of the negative, so the excellence of a Carbro is governed by the quality of the bromide used for its production. While it is true that the Carbro can be, and should be, a distinct improvement on the Bromide, a good Carbro can never be made from a poor original.

It is desirable that the bromide should be a print not over-exposed but fully developed; the shadows may even be slightly buried as full gradation will still be present, as can be seen by holding it up to the light; such shadow detail will be fully reproduced in Carbro, adding greatly to its beauty. It is essential that fixing should be complete and the hypo entirely eliminated, but "hypo-eliminators" must not be employed.

The bromide is better made on a size of paper giving at least a quarter of an inch of white margin all round; such a margin is known as a "safe edge." Its main function is to give an edge of soluble gelatine to the Carbro picture which prevents frilling up during development; a further advantage is that it allows the fingers to bring holding pressure on the pigment paper when squeegeeing without encroaching on the print itself.

If the print has been made the full size of the bromide

paper, the pigment paper used must be at least half an inch larger to provide the safe edge above mentioned. Should the silver image extend ever so slightly beyond the edge of the pigment paper after squeegeeing, then frilling may be expected during development.

## GETTING READY

A useful point to remember is that one of the prime requirements of Carbro is plenty of water and its free use. Provision should be made for this when deciding where to work.

First, the Bromide prints and the Transfer papers should be put to soak in a dish of cold water, so as to remove all air from the paper and to make sure that it is fully expanded. Thus trouble with the paper stretching and buckling is avoided at later stages. Five minutes soaking is sufficient for thin papers, but thick paper requires longer and any reasonable length of time can have no injurious effect.

It is a wise precaution to mark the back of the Transfer paper before wetting, in order that there may be no difficulty in telling the front from the back. If there should be any doubt when examining the dry transfer paper, use the tongue to moisten a corner of the paper and press it between finger and thumb; the tacky side of the paper is the coated side.

## CHEMICAL SOLUTIONS

The composition of the concentrated solutions is as follows:—

CONCENTRATED STOCK SOLUTION, No. 1.

| | | |
|---|---|---|
| Potassium Bichromate | .. | 1 oz. or 25 gms. |
| Potassium Ferricyanide | .. | 1 oz. or 25 gms. |
| Potassium Bromide | .. | 1 oz. or 25 gms. |
| Water .. .. | .. | 20 ozs. or 500 c.c. |

CONCENTRATED STOCK SOLUTION, NO. 2.

| | | |
|---|---|---|
| Glacial Acetic Acid | 1 oz. | or 10 c.c. |
| Hydrochloric Acid (pure) | 1 oz. | or 10 c.c. |
| Formaldehyde 40 per cent. | 22 ozs. | or 220 c.c. |
| Water | 1½ oz. | or 15 c.c. |

From these concentrated solutions the Working Baths are made up as follows:—

FIRST WORKING BATH

| | | |
|---|---|---|
| No. 1 Stock Solution | 6 ozs. | or 100 c.c. |
| Water | 18 ozs. | or 300 c.c. |

SECOND WORKING BATH

| | | |
|---|---|---|
| No. 2 Stock Solution | 1 oz. | or 10 c.c. |
| Water | 32 ozs. | or 320 c.c. |

The above English and Metric quantities are not equivalent, but are proportional.

In cold weather the No.1 Concentrated Solution may contain a few crystals which should be dissolved by slightly warming and shaking before measuring out the required quantity. In the case of the No. 2 Concentrated Solution a white deposit slowly forms, especially on exposure to light; this deposit cannot be re-dissolved but may be ignored entirely, provided that it is not allowed to get into the working bath.

The first bath may be used for a considerable time and can be bottled for future use if necessary, but the second bath must be frequently renewed, as it is altered by the No. 1 Solution transferred to it on each immersion. A 33-oz. bath would be sufficient for, say ten prints, 12 ins. by 10 ins.

To ensure regularity of results it is advisable to work at an even temperature of 60 to 65° F. (15 to 18° C.), and both baths should be as near the same temperature as possible. Good work cannot be done in a very hot or a very cold

room, as the temperature of the baths changes too rapidly and the room conditions also have an effect on the swollen gelatine of the pigment paper. A low temperature leads to light and flat prints, while a high temperature gives dark pictures with clogged shadows. It is difficult to work at all at temperatures above 75° F. (24° C.)

## "SENSITISING"

When everything is ready, immerse a sheet of pigment paper in the No. 1 bath, gently sliding it face upwards under the surface of the solution; rock the dish slightly to remove any airbells from the face of the pigment paper and then turn it face downwards, when it will become slightly dome shaped and should, if it shows a tendency to curl out of the solution, be pushed down with the finger; at the same time any airbells must be removed. When two minutes have elapsed the pigment paper should be turned face upwards again and the dish slightly rocked. These precautions are indicated to ensure even absorption of the solution.

After *three minutes*, lift the pigment paper out of the bath by one corner and let it drip for 15 seconds; this is simply to avoid transferring too much solution to the second bath. Then, holding the sheet by two corners on the same side, drop it face upwards into the No. 2 bath and rock the dish to ensure an even wave of the solution passing over it. The time of immersion in this bath will vary according to the result desired, as explained in the next paragraph.

## TIME OF IMMERSION IN SECOND BATH

The time of immersion in this bath is a matter of prime importance as it entirely governs the quality of Carbro produced, provided that the other stages of the process are carried out correctly.

The important point to remember is that in all circumstances a long immersion leads to a pale and flat Carbro, while short immersion gives a dense print lacking in detail in the high-lights, while in extreme cases the light tones wash away entirely; between these limits there is a *correct* time which it is necessary for the worker to find out for himself. This correct time is affected by the hardness of the water, by the make of bromide paper used, by the contrast of the bromide print, and whether the Carbro is required of the same contrast or not, and also, to a minor extent, by the number of Carbros that have previously been taken from the bromide print in use, because used bromides tend to give slightly greater contrast.

When using a normal bromide print the pigment paper should be immersed in the No. 2 bath for 20 seconds.

In districts where the water supply is very soft, the immersion time in the No. 2 bath becomes very short; under these conditions it is permissible to dilute the No. 2 solution to 1 part concentrated No. 2 solution to, say, 45 parts water, when the time of immersion required will be nearer 20 seconds.

While the pigment paper is in the No. 1 solution the bromide is lifted from the water in which it has been soaking, placed face up on a level sheet of glass, previously fitted up in the sink to act as a "squeegee board." To prevent the bromide print from slipping during squeegeeing, it should be attached to the glass by simply giving it one or two light strokes with the squeegee; a little water should then be poured on to the print. Slipping causes double images, and lack of water on the surface of the print is liable to occasion white spots in the Carbro. The number of seconds decided on having elapsed, the pigment paper is lifted from the acid bath and, without draining, held so that the edge is square with the left-hand clean margin of the bromide print; these two edges are pressed together with

the fingers of the left hand while the rest of the pigment paper is hinged down on to the surface of the bromide. In this way all air is automatically forced out and cannot interfere with the perfect contact which is required. The left hand must still hold the edge of the pigment paper steady, while the squeegee (which should be held at an angle of 45 degrees) is applied in firm straight strokes from left to right and finally from right to left. A backward and forward scrubbing movement is not so effective.

Some workers consider that more even results are obtained by passing the pigment paper from the No. 2 bath through water before squeegeeing on to the bromide print. This is best done by having the bromide face up in a large dish of water, quickly slipping the "sensitised" pigment paper under the water and on to the top of the bromide, bringing the two out together and squeegeeing immediately. The Tissue should not be in the water more than about 5 seconds.

The points to bear in mind at this stage are, that the pigment paper should be transferred as rapidly as possible from the No. 2 bath to the Bromide print, an average time being two to three seconds when no water bath is used. If there is to be much delay, the time in the bath should be correspondingly shortened.

Also the most important point of the whole process is that there must be no movement of the pigment paper over the surface of the bromide print once the two have come in contact; error here leads either to a double image and consequent blurring or else to the high-lights washing away during development. If the final Carbro shows jagged edges instead of the clean straight edges of the bromide, then there has almost certainly been movement at this stage. Successful squeegeeing is not at all difficult, but requires just a little experience which may readily be obtained by experimenting with pieces of plain paper soaked in water.

Occasionally workers find difficulty in applying the correct degree of pressure with the squeegee; if the pigment paper and bromide print cannot be pulled apart without a danger of tearing them, then pressure has been too heavy; while if they tend to fall apart slightly greater vigour is required. Very light squeegee pressure may lead to unduly light Carbros being produced.

All this explanation makes the process sound complicated; it is not really so, but it has been felt wise in this booklet to mention every possible difficulty and its effect, in order that the serious Carbro worker may identify any fault immediately it arises, and so cure it without waste of time and material.

To return to the next step in the process, the bromide with its adherent pigment paper is lifted from the glass, placed between sheets of waxed paper, and allowed to remain 15 minutes for the bleaching action on the bromide, and consequent equivalent insolubilising of the pigment paper to take place. In lifting from the glass a small palette knife is a useful asset.

Wax paper is preferable to any other as it does not allow evaporation, and so provides favourable conditions for the chemical reactions, but in order to prevent uneven effects, it is perhaps wise to rub over the back of the bromide with a pad of cotton wool to remove all excess moisture.

Some workers prefer to dispense with waxed paper, and, after wiping the backs of the bromides with damp cotton wool, to leave them exposed to the air, claiming that this allows of rougher treatment during development.

There is no objection to this, but if the prints dry too much there will be an all over increase in density of the Carbro. Care should be taken that the prints should always dry to approximately the same extent, otherwise there will be variation in the density of the prints obtained.

## COMBINED BATH OR SINGLE BATH METHOD

The following paragraph gives details for the Carbro procedure, using only one "sensitising" bath instead of the usual two. The use of such a bath considerably simplifies the process, and for Carbros much larger than, say 15 by 12 inches, becomes almost a necessity.

A formula for the Working Bath that has proved quite satisfactory is:—

| | | |
|---|---|---|
| No. 1 Concentrated Stock Solution | 2 ozs. | 40 ccs. |
| No. 2 Concentrated Stock Solution | 1 dram. | 5 ccs. |
| Water .. .. .. .. | 7½ ozs. | 300 ccs. |

To the No. 1 Solution add the water and then the concentrated No. 2 Solution and mix thoroughly.

The pigment paper is immersed in this bath at about 62° F. (17° C.) for two-and-a-half minutes only, and then squeegeed immediately on to the well-soaked bromide print. All the remainder of the process is carried out as in the more normal Two Bath Method.

The disadvantage of this Combined Bath is that it rapidly decomposes, and once it has reached this condition the resulting Carbros will tend to be hard and without detail in the high-lights. Under unfavourable circumstances this will occur within four or five hours of the Working Bath having been mixed. Therefore, it is obvious that the Stock Solutions must only be mixed just before the bath is required, and should in no circumstances be kept for future use.

If the above precaution is observed and a good quality Bromide print used, such as would require 20 seconds immersion in the Second bath of the Two Bath Method, then a good Carbro should result. But it will be obvious that varying types of bromide prints cannot all give equally good results with the same procedure, so that to get the best possible Carbro it becomes necessary

to vary the conditions or even the composition of the bath.

The exact alteration to make must be a matter of experience, but the following are the guiding principles.

To effect a slight variation in the contrast of the Carbro it is only necessary to vary the time of immersion of the pigment paper in the Working Bath, a shortened immersion leading to brightened results, while an increase of time gives flatness. The limiting times which have proved satisfactory are from 1½ to 4 minutes.

When further variation is necessary the concentration of the Bath can be altered, greater dilution leading to more contrasty and denser results and vice versa. In extreme cases the proportion of No. 2 solution used can be altered.

The beginner in the Carbro process is not advised to make use of this Combined Bath, despite the increased simplicity, as he will not find it so certain in its results, but the experienced will soon overcome these difficulties, and will find it a useful method of simplifying and speeding up work.

Those who are particularly interested in this subject are referred to the previously mentioned article in the *Photographic Journal*, March 1926, page 130.

## MOUNTING ON THE TRANSFER PAPER

The 15 minutes contact being up, separate the pigment paper and the bromide at one corner and pull the two apart. Drop the bleached bromide into a dish of cold water. Next take the Transfer paper from the water in which it has been soaked, place face up on the level sheet of glass and put a pool of water on its surface, lower the pigment paper on to it as before and squeegee. If movement takes place during this squeegeeing it is not of particular importance.

The transfer paper with the adherent pigment paper is now placed between blotting boards, lightly pressed down with the hand and left 20 to 40 minutes. Heavy pressure should not be put on the prints as this often leads to trouble in development. The longer the papers are left in contact and the drier they become, the denser the resulting Carbro will be. Large prints require to be left in contact longer than small ones. For a 20 by 16 inch print an hour in contact would not be excessive.

## DEVELOPMENT OF THE CARBRO

Development is about the simplest and certainly the most interesting part of the Carbro process.

A dish of warm water at 95 to 100° F. (35 to 38° C.) is required; the larger the dish the better, and there should be at the very least two inches of water in it. If too little water is used it cools rapidly and fresh hot water has to be added during the development, a process which occasionally leads to trouble.

The adherent pigment paper and transfer are slid under the surface of the warm water, pigment paper uppermost. In a few seconds the soluble pigmented gelatine will be seen to ooze out at the edges of the print; then lift one corner of the pigment paper, and gently strip it from the transfer paper which will be left covered with a thick layer of pigment and gelatine. During this operation the transfer paper should be kept entirely under the water as otherwise the image may tear. The original pigment paper is now finished with and can be thrown away. Holding the print by one corner with the left hand, use the other to gently lave or splash the warm water over the face of the print, thus washing away the remaining soluble gelatine and pigment. Towards the end of the development it is wise to make the water pass over the surface of the print

in waves rather than to splash; on no account touch the surface with the fingers.

The transfer paper is sufficiently strong to withstand gentle splashing without injury, but a floating piece of board to support it on is regarded by some workers as a convenient adjunct.

The development of a Carbro is considerably under control, and decided differences may be made by using hotter or colder water or by the mode of splashing. Hot water and rough splashing both serve to increase contrast.

Local control may be secured by pouring a thin stream of hotter water on to the portion of the print it is desired to specially lighten, a high-light being thus considerably brightened or a deep shadow lessened and detail revealed. Dense results cannot be obtained by cutting development short as such prints always dry streaky. When development is judged to be complete, the prints should be rinsed in clean cold water and put into a 3 to 5 per cent. solution of potash alum.

The main function of this alum solution is to remove the yellow stain left on the transfer paper by the bichromate and ferricyanide of the first bath, although it will also have a slight general hardening effect. The solution can be used for a considerable time until its failure to act shows the need for renewal.

When the yellowness has disappeared, in say 15 minutes, the print should be rinsed in cold water and hung up to dry. Hurrying the drying is to be avoided as tending to cause cockling and uneven gloss.

## TREATMENT OF BLEACHED BROMIDE

It is necessary now to return to the consideration of the bleached bromide which was put in a dish of cold water. It should be bleached to a pale yellow-brown image, but if

the deepest shadows remain partially black the Carbro will still show full shadow detail. In fact, a bromide which behaves in this way is the best type as it means that it was fully exposed and properly developed, and so will contain the maximum possible shadow detail which, owing to the nature of the image, always shows up better in a Carbro than in a bromide.

The bleached bromide should be very thoroughly washed in running water for at least 20 minutes and then re-developed in an ordinary bromide developer. Fixing is not needed. If the washing has not been thorough enough, re-development will be slow and the image will not come up a good black; such a bromide can usually be considered as spoilt.

The re-developed print, after thorough washing to remove all chemicals, is in the same condition as when new, and so can be used over again for making other Carbros. If it is necessary to make a large number of Carbros from one bromide, it is preferable to dry it in between each use, although this is not essential. It is, however, well to bear in mind that the third or fourth Carbro from any bromide will be slightly denser and more contrasty than the first, unless a very slightly longer time of immersion is given in the No. 2 bath. This effect is brought about by the successive slight intensifications of the Bromide caused by the action of the chemicals in the No. 1 bath.

## ALTERNATIVE METHOD

Instead of developing the Carbro image on a new support and re-developing the bromide, it is possible to produce the Carbro on top of the bromide image and so avoid any transferring; but it is essential to mask the negative in printing so as to provide a white safe edge to the print. This method has advantages in the matters of

ease and speed when only one Carbro is wanted, and yet offers a great improvement over the ordinary bromide print and gives a choice of colour.

The procedure is the same as in the true Carbro process up to the point where the pigment paper should be stripped from the bromide; but instead, at the end of 30 minutes contact, the two are placed still adhering into the hot water bath and developed straight away. The picture is then of a composite nature, being formed of a Carbro image on top of a faint bleached silver image. It is not wise to leave it in this condition as the bleached image will change colour on keeping, so it should be washed, fixed in plain hypo or, better, hypo and ferricyanide, and finally well washed again.

On the other hand, the silver image may be re-developed under the Carbro so that the final image is strongly intensified. This may sometimes be useful when using an under-exposed negative which will only give a very weak bromide; also unusual effects can be obtained by combining with the black Bromide print, pigment papers of suitable tones, details of which must be left to the enthusiastic experimenter.

## CARBROS FROM GASLIGHT PRINTS

Carbros are normally made from Bromide prints but, nevertheless, Gaslight papers can be used quite successfully; but it is invariably found that the first Carbro from a Gaslight print is weak, while subsequent ones are of better strength.

Consequently, to avoid waste of material, the Gaslight print should be printed strongly and first bleached in the No. 1 Carbro bath, or better still, in a bath containing only Ferricyanide and Bromide of Potassium, then thoroughly washed, re-developed and finally again well washed. In

this operation the Gaslight print is converted into the same form as a Bromide, so that Carbros can then be made as usual in accordance with the general instructions given previously.

Thus, it will be seen, it is possible to make good Carbro prints from the weak negatives which are frequently made nowadays, and which are suitable for printing on Gaslight paper.

## CAUSES OF FAILURE

As far as possible all the ordinary causes of failure have been mentioned under their appropriate headings in the earlier portions of this booklet, and the instructions given have been designed to show where a new-comer to the process might go wrong. Nevertheless, a résumé of possible faults and their effects may be of value.

If the final Carbro is not of the density or contrast required, either an incorrect time of immersion in the No. 2 bath has been given (see page 10), or occasionally the bromide print is totally unsuitable, or the squeegeeing of the pigment paper on to the Bromide has been unsatisfactory (see page 11). Movement during this squeegeeing may lead to flat results due to blurring or, in bad examples, to the loss of the high-light portions of the picture, thus giving the appearance of a hard result. Careful examination of the Carbro will always show whether the error is in the squeegeeing or in the length of immersion in the No. 2 bath.

Very weak squeegeeing also occasionally leads to light and flat Carbros (see page 12), while, of course, the temperature of the solutions is of importance (page 9).

White spots on the Carbro may be due to bubbles or airbells being allowed to adhere to the pigment paper during the "sensitising" operations, or, more frequently,

to air being imprisoned between the bromide and pigment paper when bringing the two into contact. The remedy, as mentioned on page 10, is to have a pool of water on the surface of the bromide print so that when the pigment paper is lowered on to it the air is forced out along with the water. White spots are always accompanied by corresponding dark, or unbleached, spots on the bleached bromide.

Dark spots occur occasionally in Carbro prints, but are usually due to insufficiently washed bromide prints or to chemicals, such as hypo, having been splashed on to the surface of the pigment paper or bromide.

Should the print frill at the edge during development, the usual cause is unsatisfactory "safe-edge" precautions (see page 6), but bad movement during squeegeeing can even cause this defect.

If blisters form in the middle of the print during development, probably too much local control with hot water has been attempted, or air has been trapped between the pigment paper and transfer paper, or even the wrong side of the transfer paper may have been used!

In a few districts the water supply contains a very large amount of dissolved air, which rapidly forms numerous small bubbles all over the surface of the pigment and transfer papers. This will invariably cause blistering of the prints and the only remedy is to boil all the water used, or else to allow it to stand in open dishes for a considerable time.

A peculiar difficulty that arises occasionally is that the bromide prints refuse to bleach in the lighter parts and, consequently, the Carbro is devoid of high-light tones. This has been traced to excess of lime or chalk in the water used for washing the bromide prints and, consequently, in districts where the water-supply is excessively hard, special precautions have to be taken. The remedy,

which is the removal of this lime, was first published by Messrs. Bourke and Hickman, in the *British Journal of Photography*, January 26th, 1923, page 59. The usual procedure is to place the bromide print for five minutes in an acid bath consisting of three parts of strong hydrochloric acid to 100 parts of water. It must then be washed in *running* water for not less than 10 minutes or more than 40 minutes, during which time it will not appreciably re-absorb lime; if left for a few minutes in *still* tap water the lime is re-precipitated in the gelatine.

This treatment with hydrochloric acid may immediately precede the making of the Carbro, or may be given when the bromide is made, by putting the print in the acid bath immediately following the washing after fixing. Several Carbros may be made from the same bromide print without re-immersing in the acid, but excessive washing of the bromide in the hard water should be avoided.

A similar effect is caused by the use of permanganate as a "hypo-eliminator"; in this case it is necessary to use 5 per cent. sulphuric acid to overcome the trouble.

## CHOICE OF COLOURS

The choice of colours is very naturally and properly a matter of individual taste, but generally accepted canons point to the use of blacks, browns and greens for landscape work, with a leaning towards warm sepia for rich summer effects, and to the cooler or green sepias for autumn views.

For seascapes, snapshots of yachts, studies of breaking waves, etc., the various greens and blues provide a choice of colours wide enough to satisfy the most exacting taste.

For cathedral interiors or like subjects, varied tones of black may be chosen; brown black or warm black developed on slightly toned support paper giving a charming

rendering of stone-work. Should the choir or details of stalls or other woodwork be represented, then the browns, such as Vandyke brown, Rembrandt sepia, or cool brown are more usually employed.

## TWO-COLOUR CARBRO

By using a bromide print as the base on which to develop the Carbro, it is possible to use different pigment papers for two or more portions of the picture, and so produce prints which somewhat resemble the original in colour. Such results, however, must not be confused with natural colour or three-colour Carbro, which is quite a different process.

A suitable bromide print having been found, such, for example, as a rose which it is desired to reproduce in red against a greyish green background, the steps in the process are as follows:—

(1) With the aid of a fine sable brush bleach away the rose and any other portions required to be in red. This is best done on a perfectly flat and dry print and care must be taken to get sharp outlines. The No. 1 Carbro solution may be used as the bleaching agent, but Ferricyanide and Bromide without any Bichromate are preferable. Wash out all the chemicals.

(2) Make a Carbro in green of the remainder of the picture and develop on the bromide paper. Wash out all the chemicals thoroughly and dry. The Carbro image over the bromide makes washing slow, but it is essential that in all stages the washing shall be complete.

(3) Now re-develop the rose with a concentrated developer in exactly the same way as it was bleached away in operation (1). Thoroughly wash out the developer and it is desirable to dry again.

(4) Soak the bromide for a short time, and proceed to make a Carbro in red on top of the portions just re-developed. The red and green images should now exactly coincide and complete the picture. Again the chemicals must be washed out.

(5) The final step depends on whether it is desired to re-develop the bromide underneath the Carbro, or only to re-develop portions of it, or to remove the silver entirely by fixing, or even to sulphide tone the silver. This latter operation is best carried out with a solution of hydrogen sulphide in water.

Other subjects will suggest different methods of setting to work in order to produce the best results, but undoubtedly the process offers excellent scope to the artistic worker for producing striking and effective pictures.

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